LUMEL

BARGRAPH
DIGITAL INDICATORS
NA2 SERIES

USER'S MANUAL

CE

BARGRAPH
DIGITAL INDICATORS
NA2 SERIES

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1. APPLICATION

NA2 series bargraph panel meters with digital and analog indications are destined to measure d.c. voltages and d.c. currents, temperature, resistance and other non-electrical quantities converted into electrical signals.

They can realize additional functions such as:

- overrun signalling of setting alarm values,
- overrun signalling of the measuring range,
- programmable resolution of the bargraph,
- recalculation of the measured quantity into any arbitrary quantity on the base of an individual lineal characteristic y = ax + b,
- conversion of the measured quantity into a current or voltage standard signal,
- digital communication through the RS-485 interface, with the MODBUS protocol,
- supply of two-wire object transducers (24 V) in the following measuring range executions: 0/4...20 mA, 0...1 V, 0...10 V.

With the meter we deliver:

- a warranty card,
- 2 holders to fix the meter into a panel,
- a service manual,
- a service manual for execution with an interface,
- a set of stickers with units.

When unpacking the meter, please check whether the type and execution code on the data plate corresponds to the order.

Symbols located in this service manual meant:

- Especially important, one must acquaint with this before connecting the meter.

- One must take note of this when the meter is working inconsistently to the expectations.

2. BASIC REQUIREMENTS, OPERATIONAL SAFETY

NA2 meters are destined to be mounted into panels and cubicles. In the range of operational safety, they are in conformity with the IEC 1010 standard requirements.

Remarks concerning the safety:

- The installation and meter connection should be operated by qualified personel. One must take into consideration all accessible protection requirements.
- Before switching the meter on, one must check the correctness of the network lead connection.
- One must take care especially of the protection terminal connection IEC1010-1 p. 6.10 and p. 6.11.2 standard.
- In the case of the protection terminal connection with a separate lead one must remember to connect it before the connection of network leads.
- Do not connect the meter to the network through an auto-transformer.
- Before taking the meter housing out one must turn the supply off.
- The removal of the meter housing during the warranty period causes its cancellation.

3. FITTING

Prepare a ($34^{+0.6}$ x 137^{+1}) mm hole in the panel. The thickness of the material from which the panel is made can not exceed 20 mm. One should introduce the meter from the front of the panel with disconnected supply circuit.

After introducing the meter, fasten it by means of holders.

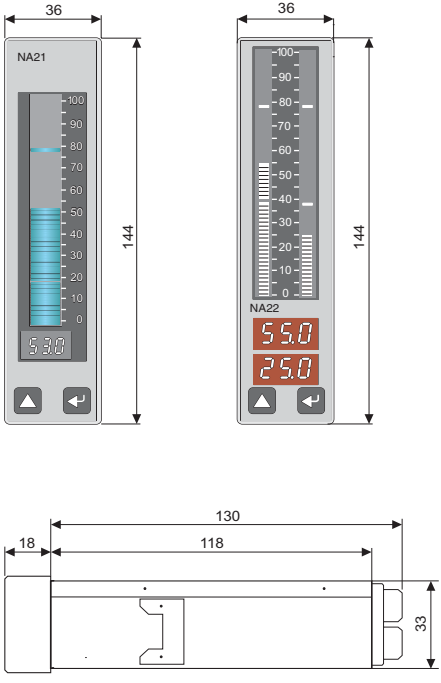
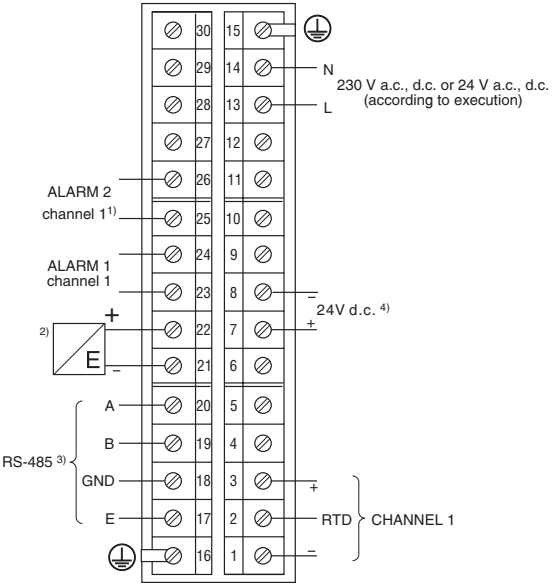


Fig. 1. Meter overall dimensions

4. CONNECTION

At the rear side of the meter there are terminal strips with screw terminals. Analog and digital outputs of the meter are galvanically isolated from other parts of the system.



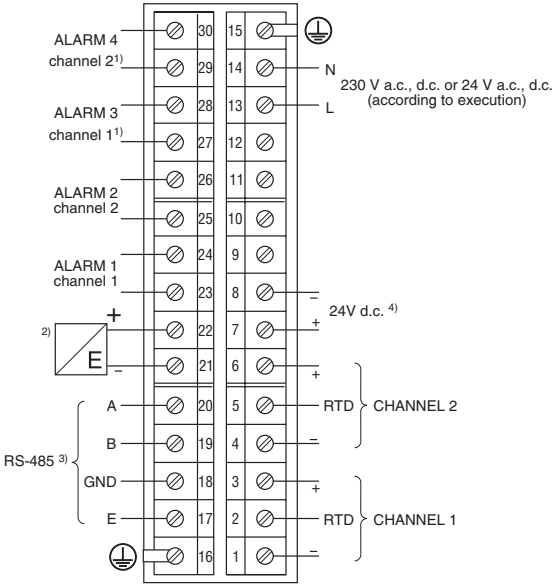
(1) - exists only in executions with two relays,

(2) - exists only in executions with a 0/4...20 mA or 0...10 V analog output,

(3) - exists only in executions with RS-485 interface,

(4) - exists only in executions with a 0/4...20 mA, 0...1 V, 0...10 V measuring range.

Fig. 2. Description of NA21 meter terminals



(1) - exists only in executions with four relays,

(2) - exists only in executions with a 0/4...20 mA or 0...10 V analog output.

(3) - exists only in executions with RS-485 interface,

(4) - exists only in executions with a 0/4...20 mA, 0...1 V, 0...10V measuring range,

Fig. 3. Description of NA22 meter terminals

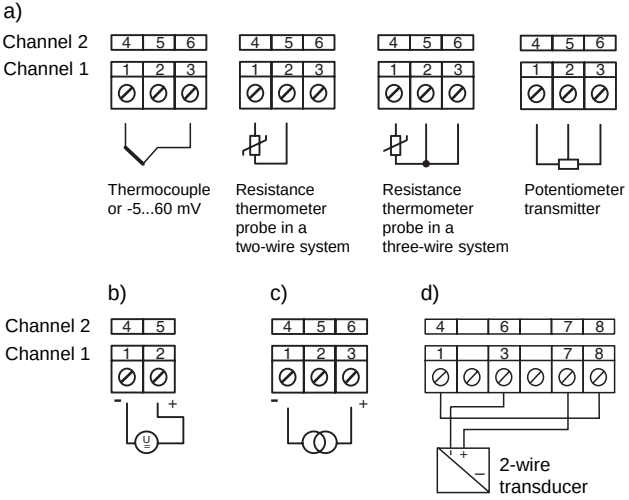


Fig. 4. Connection way of the input signal:
a/ temperature sensors and the potentiometric transmitter,
b/ voltage,
c/ current
d/ object transducers.

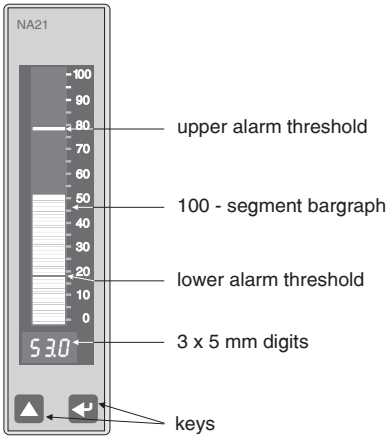
- In case of meters working in an environment of high perturbances one should use external filters.
- It is recommended to use screened leads on the output and input of the meter.

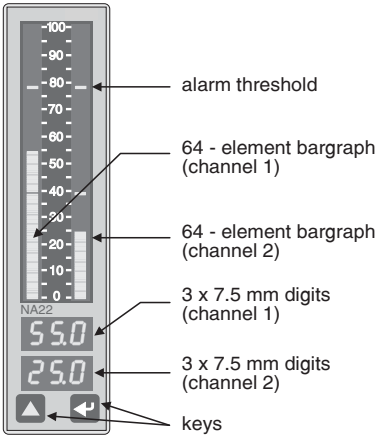
- One must use a three-wire cable as a network supplying cable. The lead section should be chosen in such a way that in case of a cable short-circuit from the equipment side, the cable would be protected by means of electrical installation fuses. Requirements towards the network cable are regulated by the IEC 1010-1 p.6.10. standard.

5. SERVICING

After switching the meter on, its name is displayed and also alarms currently set are displayed on the bargraph. The meter is transiting automatically into the measuring mode and the input signal value is displayed.

Alarm thresholds are marked as lighted or extincted segments





Key functions:

- entry into the programming mode (hold down during ca 3 seconds),
- entry and moving through the parameter group of the chosen level,
- return into the measuring mode,
- acceptation of the changed parameter value.

- displaying resolution increase of the measured quantity (in the measuring mode),
- choice of the parameter group level,
- change of the chosen parameter value,
- exit from the parameter group of the chosen level.

In case of the switched off individual characteristic, the meter establishes automatically the position of the decimal point.

A pressure of the key ▲ produces the increase of the quantity display resolution. In this mode, the oldest digit is not displayed.

The release of the key causes the return to the normal display.

A simultaneous pressure of keys ▲ and ↵ and their hold down during ca 10 seconds causes the display of the actual security code.

The operation algorythm of the meter is shown on fig. 5.

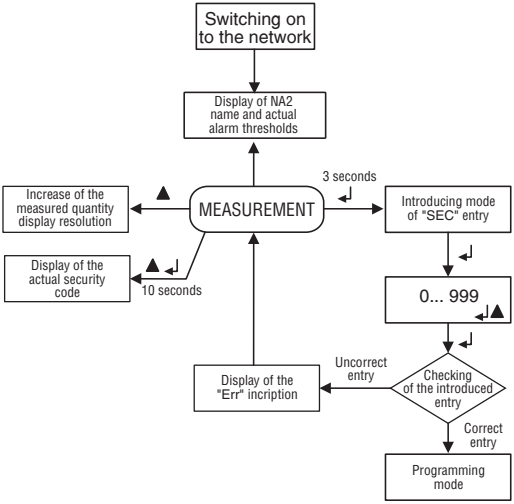


Fig. 5. Operation algorythm of the meter.

The appearance of the following symbols on the digital displays means:

- Uncorrect introducing of the security code.

- Exceeding of the upper measuring range or a lack of sensor, bargraph lighted up.

- Exceeding of the lower measuring range or sensor short-circuited, bargraph extincted.

6. PROGRAMMING

The key ↵ pressure and its holding down during ca 3 seconds causes the display of the security code symbol **SEC** alternatively with the 0 value set by the manufacturer. The entrance of the correct code causes the transition into the programming mode.

The transition matrix into the programming mode is shown on the fig. 6.

We choice the level selection by means of the key ▲, whereas the input and moving through parameters of the chosen level is carried out by means of the key ↵. Parameter symbols are displayed alternatively with their actual values. In order to change the values one should use the key ▲.

Changing way of chosen parameter values.

Each digit is changed separately by means of the key ▲ and is accepted by the key ↵.

In case of the **Y1** parameter, after accepting the last digit, one should set the decimal point by means of the ▲ key and accept it by the ↵ key.

In the programming mode, the actual level number is displayed on the bargraph by the luminescence of successive decades.

Lev No												
1	**Ch1** Channel 1	**tYP** Sensor type (1)	**Con** Kind of comp. (1)	**LiP** Number of measur.	**BrL** Lower bar-graph	**Brh** Upper bar-graph	**Ind** Linear charac-ter.	**H1** (2)	**Y1** (2)	**H2** (2)	**Y2** (2)	--- (w)
2	**Ch2** Channel 2 (3)	**tYP** Sensor type (1)	**Con** Kind of comp. (1)	**LiP** Number of measur.	**BrL** Lower bar-graph	**Brh** Upper bar-graph	**Ind** Linear charac-ter.	**H1** (2)	**Y1** (2)	**H2** (2)	**Y2** (2)	--- (w)
3	**AL1** Alarm 1	**PrL** Lower threshold	**Prh** Upper threshold	**tYP** Alarm type	--- (w)							
4	**AL2** Alarm 2 (6)	**PrL** Lower threshold	**Prh** Upper threshold	**tYP** Alarm type	--- (w)							
5	**AL3** Alarm 3 (3)(7)	**PrL** Lower threshold	**Prh** Upper threshold	**tYP** Alarm type	--- (w)							
6	**AL4** Alarm 4 (3)(7)	**PrL** Lower threshold	**Prh** Upper threshold	**tYP** Alarm type	--- (w)							
7	**OUt** Output parame-ter	**AnL** Lower analog threshold (4)	**AnH** Upper analog threshold (4)	**Chn** Channel selection (3)(4)	**Adr** Interf. addres (5)	**bAu** Baud rate (8)	**Int** Info. unit type (8)	--- (w)				
8	**Ser** Servicing	**SEt** Inscription of stan-dard para-meters	**SEC** Entry introd.	**tSt** Test display-ing	--- (w)							
0	--- (0)											

(w) - exit from the parameter group of chosen level,
(0) - exit from the programming mode,
(1) - occurs only in meters for temperature measurement,
(2) - occurs only, when the individual characteristic is included (**Ind = On**),
(3) - occurs only in two-channel meters (NA22),
(4) - parameter serviced only in executions with an analog output,
(5) - parameter serviced only in executions with RS-485 interface,
(6) - in NA21 type, serviced only in executions with two relays,
(7) - in NA22 type serviced only in executions with four relays (two relays in each channel)
(8) - parameter serviced only in execution with RS-485 interface with the MODBUS protocol.

Fig. 6. Transition matrix in the programming mode

TABLE 1

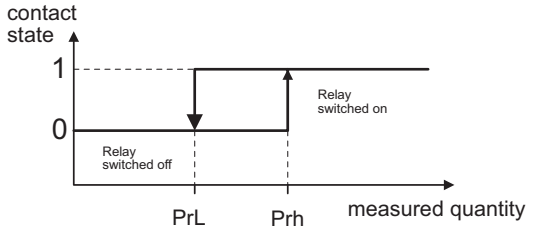
Parameter symbol	Description	Range of changes
tYP	Kind of connected sensor	Resistance thermometers: **Pt100** - Pt100 **Pt100** - Cu100 **Pt100** - Ni100 Thermocouples: **t J** - J (Fe-CuNi) **t H** - K (NiCr-NiAl) **t E** - E (NiCr-CuNi) **t n** - N (NiCrSi-NiSi) **t r** - R (PtRh13-Pt) **t S** - S (PtRh10-Pt) **nAP** - Voltage measurement **nAd** - Potentiom. transm.
Con	Kind of compensation of sensor working condition changes: - in case of a resistance thermometer it concerns the resistance change compensation of leads connecting the sensor with the meter. - in case of a thermocouple it concerns the compensation of reference junction	**Aut** - automatic compensation (In case of thermoresistances, requires a three wire line. In case of a potentiometer transmitter the automatic function is switched off.) - **0...50**°C for thermocouples, fiducial temperature value in °C. - **0...50 Ω** for thermoresistances and the potentiometric ransmitter, the reswistance of two conductors in **Ω** . Accuracy of data introducing: ± 0.1 Writing down of values from the manual compensation interval causes the automatic compensation switching on.

LiP	Number of averaged measurements	**1...999**
BrL	Parameter for setting a *magnifier* on the bargraph. Lower threshhold. The value of the input signal at which the bargraph is to be blanked.	**-199...998**
Brh	Parameter for setting a *magnifier* on the bargraph. Upper threshhold. The value of the input signal at which the bargraph is to be totally ligthed.	**BrL+1...999**
Ind	Switch off or on of user's individual linear characteristic.	**On** - characteristic switched on **OFF** -characteristic switched off
H1,Y1, H2,Y2	Parameters of the individual characteristic. On the base of given coordinates for two points by the user, the meter assigns parameters of the individual characteristic.	**-199...999** In case of the parameter Y1 there is the possibility to set the decimal point by means of the key ▲: **0.00; 00.0; 000**
PrL	Lower alarm threshhold	**-199...999**
Prh	Upper alarm threshold	**-199...999**
tYP	Kind of alarm. Fig. 7. shows the graphical illustration of different alarm types.	**nor** - normal, **On** - switched on **OFF** - switched off

AnL	Parameter responsible for the analog output. The value of the measured input signal to which 0 on the analog output will correspond.	**-199...998**
Anh	Parameter responsible for the analog output. The value of the measured input signal to which the maximal signal on the analog output will correspond. **10 V**, for the voltage output, **20 mA** for the current output.	**AnL+1...999**
Chn	Channel number, from which the measurement result will be transmitted to the analog output.	**1, 2**
Adr	Device address. Parameter responsible for digital output.	**0**...999 for LUMBUS protocol 1...247 for MODBUS protocol
bAu	Baud rate for the MODBUS protocol.	240 - 2400 bit/s 480 - 4800 bit/s 960 - 9600 bit/s
Int	Information unit type for the MODBUS protocol.	odd - information unit with an odd parity bit. EvE - information unit with an even parity bit.
SEt	Writing down of manufacturer's settings. parameter values set up by the manufacturer are shown in the table 2.	A pressure of the key ▲ causes the writing down of standard parameters into the meter. The execution of this operation is signalled by the inscription **End**.

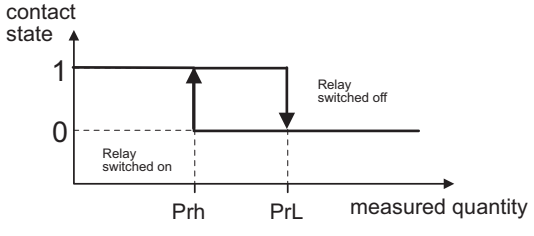
SEC	Introduction of a new entry (password)	0...999
tSt	Displays and bargraph test	A pressure of the key ▲ causes the lighting of all segments. A pressure of the key ↵ ends the test.
- - - (W)	Exit out of the parameter group of the chosen level.	A pressure of the key ▲ causes the exit out of the parameter group of the chosen level.
- - - (0)	Exit out of the programming mode. The meter has also an automatic exit out of the programming mode if during ca 1 min. we do not press any key.	A pressure of the key ↵ causes the exit out of the programming mode. The exit out of the programming mode is signalled by the inscription **End**.

a)



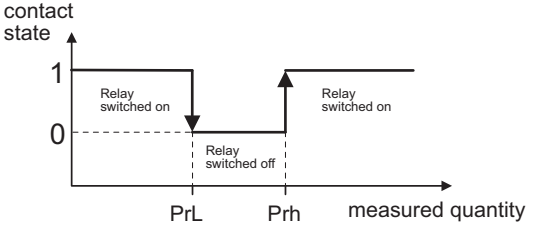
Prh > PrL

b)



Prh < PrL

c)



d)

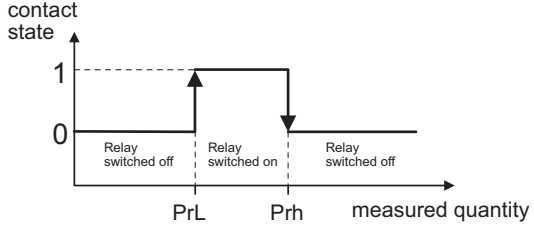


Fig. 7. Alarm types

a), b) normal *c) switched off* *d) switched on*

CAUTION !

- In case of **On** and **OFF** alarm types, the writing down of **PrL>Prh** causes an automatic transcription of the value from the threshold **PrL** into **Prh** and from **Prh** into **PrL**.

  The alarm type will not change.

- In case of a measuring range exceeding the relay reaction is concordant with written down **PrL**, **Prh**, and **tYP** parameters, and when:
  a) upper measuring range will be exceeded, then the measured quantity = 1000,
  b) lower measuring range will be exceeded, then the measured quantity = - 200.
- In case of meter operation with a resistance thermometer in a two-wire system the choice of the automatic compensation of lead resistance changes will cause a defective meter work.
- The option choice of the automatic lead resistance compensation during the meter operation with a potentiometric transmitter causes the same effect as the manual compensation switching on and writing down the 00.0 value.
- In case of an individual characteristic switching on **(Ind=On)** the measurement result is transformed linearly in accordance with introduced **H1**,**Y1**,**H2**,**Y2** parameters.
- The meter checks up the value of the actually introduced parameter after accepting the last digit. In case when the introduced value is discordant with the range of changes given in the table 1, the meter will make an automatic correction of this value i.e.: if the introduced value is smaller than the lower range threshold then the meter will remember the lower range threshold value, however if the introduced value is greater than the upper range threshold then the meter will remember the upper range threshold.

- If in case of a *magnifier* setting on the bargraph, **BrL>Brh** will be introduced, then the meter will introduce the maximal value as the **Brh** upper threshold value, that is **999**.
- The meter has standard parameters writen down by the manufacturer. They are given in the table 2.

Table 2

Parameter symbol	Level in the matrix	Standard value	
		NA21T NA22T	others
tYP	1,2	Pt1	—
Con	1,2	rEn = 0	—
LiP	1,2	1	1
BrL	1,2	-199	min. range
Brh	1,2	850	max. range
Ind	1,2	OFF	OFF
H1,Y1,H2,Y2	1,2	0	0
PrL	3,4,5,6	-199	min. range
Prh	3,4,5,6	850	max. range
tYP	3,4,5,6	OFF	OFF
AnL	7	-199	min. range
Anh	7	850	max. range
Chn	7	1	
Adr	7	0	
Bau	7	960	
Int	7	odd	
SEC	8	0	

7. TECHNICAL DATA

Panel meter dimensions	144 × 36 × 130mm
Protection index ensured from the meter frontal side	IP 50
Protection index ensured by the housing	P 40
Protection index ensured from the terminal side	IP 00
Rated operating conditions:	
- supply voltage depended on the execution code	90...230...253 V a.c., d.c. 20...24...40 V a.c., d.c.
- supply voltage frequency AC	40...50...440 Hz
- ambient temperature	0...23...50°C
- air relative humidity	< 75% (water vapour condensation non admissible)
- working position	vertical
Power consumption	max 10 VA
Storage temperature	-20°C...+70°C
Display field:	
- NA21	self-illuminating display (green - blue) 3 digits, 5 mm high, 1 bargraph with a 100 segments 84 mm long
- NA22	2 LED displays 3 digits, 7.6 mm high 2 bargraphs with 64 segments 92 mm long
Indication range of the digital display	-199...999

Bargraph resolution	programmable
Bargraph accuracy	± 1 segment
Operation (servicing)	two ↵ ▲ keys

Relay outputs:

- programmable alarm thresholds,
- three types of alarm (see paragraph 6),
- hysterezis defined by means of the lower and upper alarm threshold,
- signalling of thresholds on the bargraph,
- 1 or 2 relays per channel (depended on the execution),
- voltageless contacts - make contacts - maximal load capacity:
  - voltage - 250 V a.c., 220 V d.c.
  - current - 1 A d.c., a.c.
  - power - 125 VA, 60 W

Analog output:

- programmable (current) load resistance ≤ 500 Ω ,	0/4...20 mA,
- programmable (voltage) load resistance ≥ 500 Ω ,	0...10 V,
- galvanically isolated,	
- resolution:	0.025% of the range
- basic error:	0.2% of the range
- additional error resulting from ambient temperature changes	0.1%/10K

Digital output:

- RS-485, baud rate: 9600 bauds with the LUMBUS protocol
- RS-485, baud rate: 2400, 4800, 9600 bauds with the MODBUS protocol

Two-wire supply of object transducers	24 V d.c./max. 50 mA (mass - terminal 8; plus - terminal 7). Galvanical isulation from the supply voltage

Resistance against supply decays

- lack of supply ≤ 20 ms	without effects
- lack of supply > 20 ms	automatic restart

Electromagnetic compatibility:

- immunity	acc. EN 50082-2 (1996)
- emission	acc. EN 50081-2 (1996)

Safety requirements:

according IEC 1010-1 standard:

- installation category	class III
- level of pollution	2
- maximal voltage in relation to the earth	300 V a.c.

Meter parameters for voltage and current executions:

- input resistance for ranges:	
- voltage ranges	Ri =1 MΩ ± 10%,
- current ranges	Ri ≤ 10 Ω ,
- long-term exceeding of range	10%
- basic error:	0.2% of range ± 1 digit
- additional errors in rated working conditions of use in % of measuring range:	
- from ambient temperature changes	0.1%/10K
- from supply voltage changes	to leave out of account
- from supply voltage frequency changes	to leave out of account

Meter parameters for temperature executions:
Thermocouples:

Table 3

sensor	measuring range	basic error (% range ± 1digit)
J (Fe-CuNi)	(-20...+999)°C	0.1
K (NiCr-NiAl)	(-50...+999)°C	0.1
N (NiCrSi-NiSi)	(-50...+999)°C	0.1
E (NiCr-CuNi)	(-20...+800)°C	0.1
S (PtRh10-Pt)	(-50...+999)°C	0.5
R (PtRh13-Pt)	(-50...+999)°C	0.5
Voltage	-5...60 mV	0.1 (additional errors as for voltage ranges)

Characteristics according IEC

RTD Resistance thermometers:

- current intensity flowing through the resistance thermometer < 0.16 mA
- resistance of leads connecting the resistance termometer to the meter < 20 Ω /1 conductor

Table 4

sensor	measuring range	basic error (% range ± 1digit)
Pt100	(-199...+850)°C	0.1
Cu100	(-50...+180)°C	0.2
Ni100	(-60...+180)°C	0.2
Potent. transmitter	(0... 400) Ω	0.1 (additional errors as for voltage ranges)

Characteristics according IEC.

Additional errors in rated working conditions:	
- compensation of temperature cold junction changes:	
- J, K, N, E, S (+100...+999°C), R (+100...+999°C)	± 2°C ± 1°C/10K
- S, R (-50...+100°C)	± 4°C ± 1°C/10K
- compensation of conductor resistance changes	± 2°C
- from ambient temperature changes	± 1°C/10K
- from supply voltage changes	to leave out of account
- from supply voltage frequency changes	to leave out of account
Time of preliminary heating	5 minutes
Weight	700 g
Measuring system:	
- measuring transducer	U/f
- resolution	12 bits
- measurement time:	
- temperature executions	1 sec./channel
- other executions	0.2 sec./channel

8. ORDERING PROCEDURE

Table 5

NA2 METER							
Channel number and display colour:							
one channel* blue-green	**1B**						
two channels* green	**2G**						
two channels* red	**2R**						
two channels* red + green	**2D**						
Input							
d.c. current		**I**					
d.c. voltage		**U**					
temperature		**T**					
Measuring range:							
programmable for T			**00**				
0...60 mV			**01**				
0...150 mV			**02**				
0...200 mV			**03**				
0...300 mV			**04**				
0...1 V			**05**				
0...2 V			**06**				
0...10 V			**07**				
0...20 V			**08**				
0...200 V			**09**				
0/4...20 mA			**10**				
0...200 mA			**11**				
0...2 A			**12**				
custom-made			**99**				
Alarm outputs:							
1 relay per channel				**1**			
2 relays per channel				**2**			
Output:*							
without output					**0**		
current analog output (0/4...20mA)					**1**		
voltage analog output (0...10V)					**2**		
RS-485 LUMBUS interface					**3**		
RS-485 MODBBUS interface					**4**		
Supply voltage:							
230 V a.c., d.c.						**1**	
24 V a.c., d.c.						**2**	
Acceptance tests:							
without a quality inspection certificate							**0**
with a quality inspection certificate							**1**
according customer's agreement **							**X**

* - one channel - fluorescent displays
- two channels - LED displays

** - the manufacturer establishes the execution number

In case of a custom-made execution need and for more detailed information please contact the manufacturer′s Export Department.

In case of meter deterioration, please contact your distributor.

ORDERING WAY

In the order, one must specify the name and the execution code of the NA2 meter using the table 5.

Example:

NA2: 2G-U-02-2-2-2-1 bargraph meter **means:**

an NA2 type meter with two channels and green display colour, d.c. voltage input, measuring range: 0...150 mV, with two relays per channel, with a voltage analog output (0...10 V), supply voltage 24 V a.c./d.c., with a quality inspection certificate.

9. MAINTENANCE AND WARRANTY

The NA2 indicator does not required any periodical maintenance.
In case of some incorrect unit operations:

1. In the period of 12 months from the date of purchase:
   One should take the instrument down from the installation and return to the Manufacturer′s Quality Control Dept. If the unit has been used in compliance with the instructions, the manufacturer warrants to repair it free of charge.
2. After the warranty period:
   One should turn over the instrument to repair in a certified service workshop. The disassembling of the housing causes the cancellation of the granted warranty.
   Spart parts are available for the period of ten years from the date of purchase.

The manufacturer reserves the right to make changes in design and specifications of any products as engineering advances or necessity requires.

March 2004